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A NEW BLADDER FLUKE FROM THE FROG*

BY
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Bladder flukes have been reported a number of times from North American frogs but as yet very little work has been done on these forms in this country. The European species, however, have received more attention and their complete life histories have been worked out. In North America the studies on frog bladder flukes have been carried on by only four authors, namely Leidy (1851), Bensley (1897), Stafford (1902, 1905), and Cort (1912). The localities from which these were reported are Toronto, Canada; Rice Lake, Ontario, Canada; Urbana, Illinois; Bemidji, Minnesota; and North Judson, Indiana. The writer has at hand another species of frog bladder fluke from *Rana catesbiana* taken at Stillwater, Oklahoma.

In view of the fact that Cort (1912) has given a thorough review of the literature as well as a discussion of the nomenclature of this group, it is unnecessary to take up the history of the literature any farther at this time. The frog bladder distomes have been grouped into two genera by Looss and called *Gorgodera* (1899) and *Gorgoderina* (1902). The basis for this classification is on the number of testes which these animals have. The genus *Gorgodera* has nine testes while *Gorgoderina* has two. Of the latter genus there are known from North America three species, namely *Gorgoderina simplex* Looss, *G. translucida* Stafford and *G. attenuata* Stafford. Of the former genus there have been two species described, namely, *Gorgodera amplicava* Looss and *G. minima* Cort. The writer adds another species to the genus *Gorgodera*.

GORGODERA CIRCAVA NOV. SP.

In the summer of 1918 the writer found in the urinary bladder of a large bull frog (*Rana catesbiana*) twenty trematodes (Figs. 1 and 2) which belong to a new species of the genus *Gorgodera*. In the early part of the summer of 1919 another bull frog yielded two specimens of the same species of trematode. These forms were so firmly attached to the wall of the urinary bladder by means of the acetabu-

*Contribution from the Parasitology Laboratory of the Oklahoma Agricultural Experiment Station, Stillwater, Oklahoma.

lum that it was necessary to tear the bladder apart in order to make the worms release their hold. The worms were killed by dashing hot corrosive acetic over them when they were well extended. In this way they were only very slightly contracted when killed.

It was thought at first that this form belonged to the species *Gorgoderia amplicava* Looss. Unfortunately, specimens of this species could not be obtained for comparison. From a study of the descriptions of *G. amplicava* in the literature on bladder flukes it was concluded that the species were not the same. The only other species of this genus known in North America is *Gorgoderia minima* Cort. That species is much smaller than the one to be described here. The European forms are all much larger than any of the American species of *Gorgoderia*.

This species of distome is similar in activity and habit to the others of this genus. The anterior portion of the body is very active and moves about freely while the posterior region is less active but not sluggish. The cuticle of the anterior part of the body is marked with minute longitudinal striations. These markings extend to or slightly beyond the acetabulum. The part of the body which is anterior to the acetabulum is cylindrical but becomes flattened near the acetabulum while the posterior portion is somewhat flattened and rather opaque. The opacity extends from the posterior end forward to the region of the ovary. That portion of the body occupied by the ovary, vitellaria and acetabulum is fairly transparent.

The length of the animal varies from 2.5 to 3.75 mm. with a width of .5 to .65 mm. in the region posterior to the ventral sucker. This form appears to be considerably smaller than *Gorgoderia amplicava* which has a length of 3 to 5 mm., and larger than *G. minima*, that form being 1 to 2 mm. in length. The individuals which measure 2.5 mm. in length have large numbers of eggs in the uterus while in those of the larger size this organ is entirely filled throughout giving it the appearance of being a mere egg sac. In individuals which are less than 2.5 mm. in length no eggs are developed.

The ventral sucker ranges from .60 to .75 mm. in diameter and is surrounded by a distinct circular sheath 0.05 to 0.135 mm. in width (Figs. 1 and 2, vss). This circular sheath around the acetabulum is very marked and is a rather distinct characteristic in this form. Therefore, I wish to propose the name *Gorgoderia cirçava* for this species.

The sheath around the sucker forms a distinct space or cavity between the wall of the sucker and structures of the body (Fig. 7). Small muscle bands (Fig. 7, mb) bind the tissues of the body to the ventral edge of the sucker. There are also a few muscle bands and connective tissue fibers extending across the cavity which connect the sucker with the internal parts of the body. From the external appearance of a normal animal the sheath is only slightly apparent from a side view and appears only as a slight bulge around the sucker. In an animal with both ends curved ventrally the sheath forms a distinct fold around the acetabulum (Fig. 4). The ventral sucker with the circular sheath produces a structure from .65 to .8 mm. in diameter, which is somewhat broader than the greatest breadth posterior to the sucker. The oral sucker has a diameter ranging from .30 to .37 mm. with an average of .33 mm. for ten specimens. The ratio of the oral sucker to the ventral sucker ranges from 1.8:1 to 2.3:1 with an average for ten specimens of 2.1:1. As stated by Cort (1912:162) the acetabulum of *G. amplicava* is 2.5 to 3 times the size of the oral sucker. Therefore, *G. circava* is different in this respect.

The mouth is situated in the oral sucker and appears as a triangular orifice in the posterior part of the sucker. The esophagus (Fig. 1, e) is a short narrow tube 0.14 mm. in length and 0.03 mm. in width. The intestinal ceca (Fig. 1 and 2, i) are about 0.055 mm. in width and are dorsal extending from the esophagus to within a short distance of the posterior end of the body. They are widely separated to give room for the reproductive organs which lie between as well as ventral to them. The ceca are dorsal and lateral to the testes. Some folds of the uterus pass to the lateral margins of the body and lie outside the ceca.

The reproductive system of *Gorgodera circava* is similar to that of the other species of this genus. The principal differences lie in the relative size and shape of parts, such as the number of vitellaria, shape of ovary, seminal vesicle and ejaculatory duct. There are nine testes, five on the same side with the ovary and four on the other. They are irregular in shape and the anterior ones are somewhat larger than those posterior. The shapes and sizes of the individual testes vary in different individuals but in general those which are anterior are proportionately broader than those posterior. With one exception the testes range about 0.23 mm. in length, 0.14

to 0.17 mm. in breadth and 0.22 mm. in thickness. The testis which is most posterior is usually much smaller than the others, measuring about 0.17 mm. in length by 0.12 mm. in breadth and 0.21 mm. thickness. The testes on either side are connected by minute tubules. From the dorso-anterior edge of the anterior testis on each side arises the vasa efferentia (Fig. 5, ve). These tubules extend anteriorly and unite in the region of the vitellaria to form the vas deferens which passes forward to the vesicula seminalis (Fig. 3, ves). The vesicula seminalis is a large pyriform sac dorsal to the anterior edge of the ventral sucker. It has a length of 0.15 to 0.2 mm., breadth of 0.14 mm. and thickness of about 0.15 mm. The shape and size is somewhat modified according to the degree of expansion or contraction of the worm. The vesicula seminalis is entirely filled with sperm cells. From the dorso-anterior edge of the vesicula seminalis the ejaculatory duct (Fig. 3, ed) arises and curves ventrad for some distance and then extends forward to the common genital pore (Fig. 3, g). This duct has a total length of 0.16 mm. and in the proximal region has a diameter of 0.015 mm. Around the distal portion of the duct are grouped the prostate glands (Fig. 3, p), a group of unicellular gland cells. In this region the ejaculatory duct is much enlarged forming a large pouch (Fig. 3, ep), or lumen in the midst of the prostate gland. This pouch or enlargement of the duct is 0.07 mm. in length and 0.05 mm. in diameter. The ejaculatory pouch as well as the duct is filled with sperms.

The vitellaria (Fig. 2, v) are immediately posterior to the ventral sucker and anterior to the ovary. They are made up of two groups of six to eight follicles each. One group lies toward each side of the animal and they are connected by a transverse vitelline duct. This duct becomes enlarged to form the vitelline reservoir in the median line of the body (Fig. 6, vr). From the dorsal surface of the vitelline reservoir arises a small median vitelline duct (Fig. 5, vd) which passes dorsal into Mehlis' gland where it unites with the ootype.

The ovary is a distinct three-lobed structure 0.27 mm. in length, 0.24 mm. in breadth, and 0.21 mm. in thickness. This organ lies toward the ventral side of the body. It may occur on either the right or left side as about half of the specimens studied showed it on one side and the other half on the other. The oviduct arises from the dorsal surface of the ovary as a funnel-shaped structure with the broad part of the funnel attached to the ovary. It extends

dorsad for some distance as it becomes narrow and then curves laterally or anteriorly, after which it enlarges immediately into the fertilization space (Figs. 5 and 6, f). It then becomes narrow again and passes forward near the dorsal surface of the animal to Mehlis' gland (Figs. 5 and 6, m) where it changes into the ootype. Mehlis' gland is a small group of unicellular gland cells located between the posterior edges of the vitellaria and dorsal to the transverse vitelline duct. Laurer's canal (Fig. 5 and 6, l) passes from the proximal region of the oviduct between the fertilization space and the ootype and makes a slight lateral curve. It then goes anteriorly and dorsally to the point where it opens on the dorsal surface of the body either dorsal or lateral to the ovary.

In passing from the ootype the uterus curves ventrad and bends back on itself (Fig. 5 and 6, u) in the median line of the body and goes posteriorly between the testes and finally reaches the posterior extremity of the body, where it fills with its numerous coils the region of the body posterior to the ovary and testes. The coils of the uterus become filled with eggs. Small masses of sperm cells are scattered throughout the coils of the uterus. The uterus finally emerges from the mass of coils in the region of the anterior testes (Fig. 2) and extends forward ventral to the ovary and vitellaria, passes dorsal to the ventral sucker and ventral, or slightly lateral to the vesicula seminalis to the genital pore (Fig. 3).

The eggs of *Gorgoder a circava* increase in size as they develop and pass from the ootype to the genital pore as in other species of the bladder flukes. In this case only the eggs in preserved specimens have been studied and no doubt there has been some shrinkage through the process of preservation. The eggs at the ootype measure about 0.016 mm. in length by 0.013 mm. in breadth; at the posterior end in the coils of the uterus 0.025 mm. in length by 0.019 mm. in breadth; while at or near the genital pore where they contain fully developed embryos, about 0.030 mm. in length by 0.023 mm. in breadth.

The chief differences between the American species of *Gorgoder a* lies in the size and shape of the animals; the structure, size and ratio in sizes of suckers; and the shape and relationship of the reproductive organs. *Gorgoder a minima*, described by Cort (1912) is the smallest of the three species, it being 1 to 2 mm. in length and its acetabulum is 1.6 to 2 times the size of the oral sucker. *Gorgoder a amplicava*

first described in this country by Bensley (1897), and reviewed by Stafford (1902), and again compared with *Gorgoderia minima* by Cort (1912), is considerably larger being 3 to 5 mm. in length and its acetabulum is 2.5 to 3 times the size of the oral sucker. *Gorgoderia circava* is 2.5 to 3.75 mm. in length and the acetabulum ranges from 1.8 to 2.3 times the size of the oral sucker. The acetabulum is also surrounded by a distinct circular sheath which is a distinctive characteristic of this species. In *Gorgoderia circava* the vitellaria are composed of six to eight follicles in each group while *Gorgoderia amplicava* has eight to ten in each and *Gorgoderia minima* has nine to eleven. The ovary of *Gorgoderia circava* is a distinct three-lobed structure while in *G. minima* it is only slightly lobed and in *G. amplicava* it has three to five irregular lobes with smaller or secondary lobes. The presence of the ejaculatory pouch in *Gorgoderia circava* is another structure not found in either of the other species. The differences in the reproductive organs and the presence of the circular sheath around the acetabulum clearly sets *Gorgoderia circava* off from the other species.

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EXPLANATION OF PLATE XIII

All drawings made with the aid of camera lucida.

- Fig. 1. Dorsal view of *Gorgoderia circava*, X35.
 Fig. 2. Ventral view of *Gorgoderia circava*, X35.
 Fig. 3. Reconstruction from sagittal sections showing ends of reproductive organs and genital pore, X130.
 Fig. 4. Outline drawing of small specimen which is bent ventrally at both ends causing the acetabular sheath to form fold around sucker, X35.

Fig. 5. Reconstruction of female genital organs from sagittal sections, X120.

Fig. 6. Reconstruction of female genital organs from frontal sections as seen from dorsal view, X120.

Fig. 7. Sagittal section through ventral sucker to show ventral sucker sheath, X35.

Abbreviations

<i>e</i>	esophagus	<i>ov</i>	oviduct
<i>ed</i>	ejaculatory duct	<i>p</i>	prostate gland
<i>ep</i>	ejaculatory pouch	<i>u</i>	uterus
<i>ex</i>	excretory pore	<i>v</i>	vitellaria
<i>f</i>	fertilization space	<i>va</i>	vas deferens
<i>g</i>	genital pore	<i>ve</i>	vasa efferentia
<i>i</i>	intestinal ceca	<i>ves</i>	vesicula seminalis
<i>l</i>	Laurer's canal	<i>vd</i>	median vitelline duct
<i>m</i>	Mehlis' gland	<i>vr</i>	vitelline reservoir
<i>mb</i>	muscle bands	<i>vs</i>	ventral sucker
<i>o</i>	ovary	<i>vss</i>	ventral sucker sheath
<i>os</i>	oral sucker	<i>t</i>	testes

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VOL. XXXIX

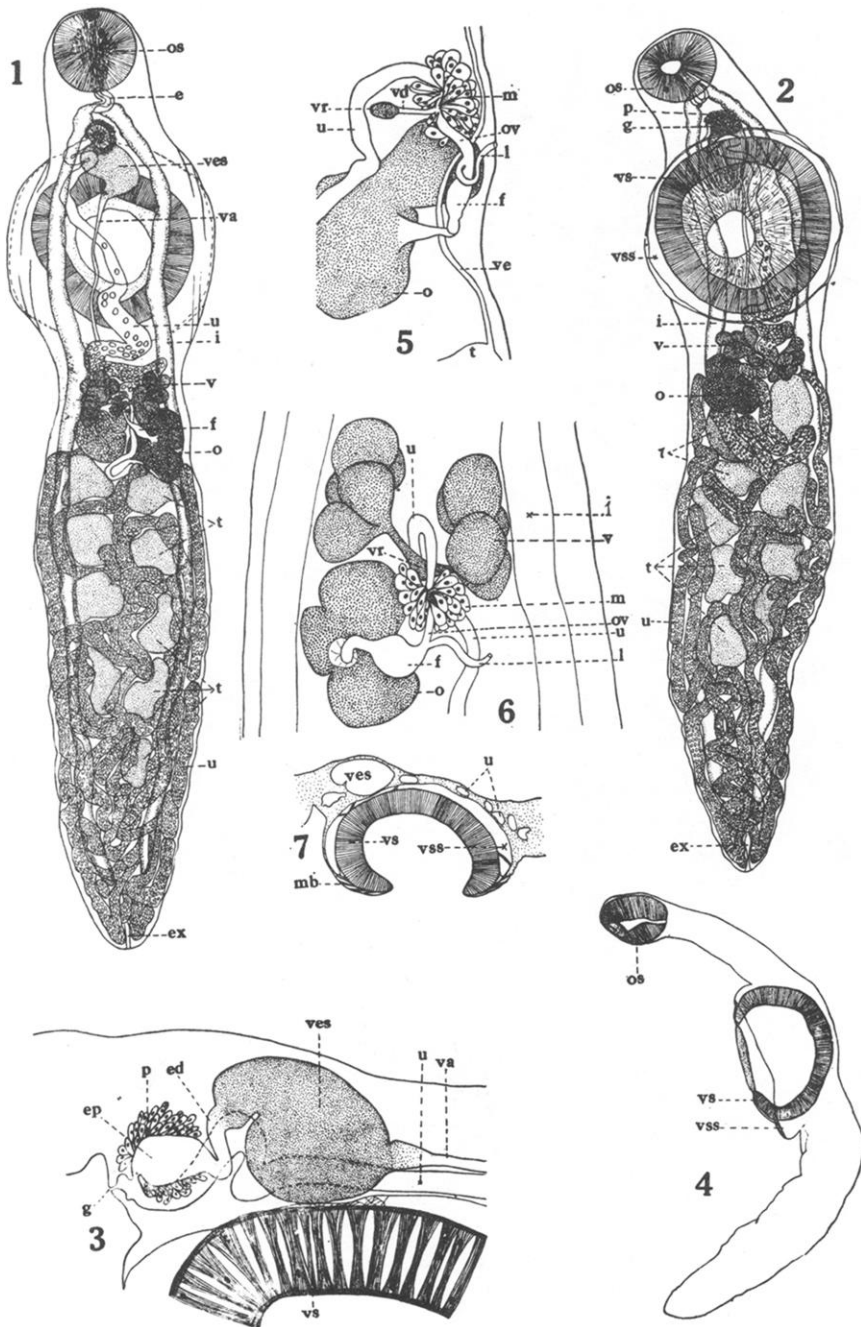


PLATE XIII

GUBERLET